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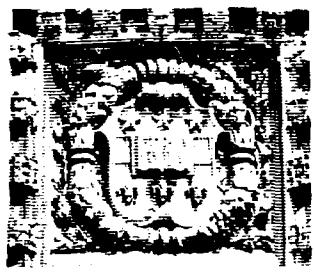
ABSTRACT

The prospects and problems associated with getting American higher education to utilize more fully electronic technologies are examined. Part I surveys the diversity of higher education and its students and concludes that technological applications will have to be correspondingly varied, despite the tendency to "massification". Part II, consisting of four case studies, makes the points that there is no overwhelming enthusiasm for technology among faculty, students or administrators and that all groups favor small-scale enterprises which emphasize human contacts. Part III focuses upon ways to increase innovation and curb restraints, examining the role of faculties in innovation, academic disciplines as factors in change, and student power; it draws the conclusion that technological innovation is most likely to occur in new academic programs and in emerging educational models such as external degree programs. Part IV scrutinizes the concept of innovative networks and concludes that such associative relationships are necessary to the success of the fourth--i.e., the technological--revolution. (PB)



WASHINGTON UNIVERSITY

MEMORANDUM No. 73/5 DECEMBER, 1973

HOW TO MAKE "THE FOURTH REVOLUTION"

HUMAN FACTORS IN THE ADOPTION OF ELECTRONIC INSTRUCTIONAL AIDS

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INTRODUCTION

The purpose of this memorandum is to examine the prospects and problems of getting U.S. higher education--educational institutions of all kinds beyond the high school--to more fully utilize electronic technologies. Our title reflects due respect for our practical engineering friends as well as a response to the challenge of a large vision.

The Carnegie Commission on Higher Education (1972) has projected The Fourth Revolution in their report by the same name. By the year 2000 they expect that in the USA as much as 20 percent of instruction in traditional post-secondary institutions and 80 percent in extra-mural institutions may employ electronic technologies--television, tape recorder, computer, and radio. To assure this eventuality, the Commission offers 13 recommendations and urges the allocation of several billion tax dollars. Should this come to pass, as Eric Ashby points out in the Commission's report, there will have been a revolution as epochal as the inventions of written language, printing, and the school itself.

The Commissions's case for The Fourth Revolution is based on projected economic and educational advantages--assuming greater numbers of students, of subject matters, and of societal demands. It is an expansive, U.S.-style scenario that may be rewritten by the demographic and cultural changes now in evidence. But this is not our point here. We accept the Commission's goals and projections and go on to inquire "What sociological and psychological factors and what political factors in U.S. higher

education will help or hinder adoption of electronic instructional techniques?" This is our concern. And we address our observations to planners and policy makers who would further The Fourth Revolution. We do not question the desirability or the practical importance of the Commission's recommendations. More money and new administrative structures in Washington and in the regions are no doubt necessary to promote the "Revolution." But what else is needed?

Our subject matter is the kind of change that is not engineered by or evolved from the logics of economics or technology alone. The differences in organizations, attitudes and customs of different kinds of students, teachers, administrators, and publics are crucial factors in innovation that are commonly disregarded or dismissed as "irrational."

Now a word as to how we conducted our inquiry and wrote it up. Demerath collected materials on the associations and agencies of higher education in the USA. These materials were supplemented by interviews with some thirty leaders of national groups in the autumn of 1972. A literature search was conducted by both authors. Then in the spring and early summer of 1973, Ms. Daniels made the field visits and did the first draft analysis of the four case studies which comprise much of Part II of the report. Both authors are responsible for the final draft.

In some cases administrators and teachers were very frank with us about mistakes they made in bringing technology into their schools. They were candid too about problems they encountered with faculties, boards, and students; and about their plans for the future. For their sakes we have given fictitious names to our case studies.

Part One

RECOGNIZE THE DIVERSITY OF HIGHER EDUCATION, U.S.A.

Few aspects of American life are as stereotyped and mythologized as post-secondary education. The degree of sentimentality and awe with which the idea of college or university is hedged about reflects, of course, the extensive anxiety over status and success of most Americans, a condition that has only been exacerbated as the middle classes become the middle mass in the modern period. The limited experiences that most of us have with colleges--not least the limited experience of academic people themselves-- is all too easily over-generalized to encompass all of American higher education. Thus, if we have been state university students or teachers, it is the category of state universities that we generalize to the entire post-secondary scene. If we are Harvard, Chicago, or Yale, "university" means that kind of institution. Or if we are graduates or teachers at small sectarian colleges, then these are seen as "American higher education". It is sometimes said that U.S. higher education is an "establishment", a "system". Nothing could be further from the truth.

The fact is there is a great diversity of institutions and interests, memberships and sponsorships. There is not one higher education lobby in Washington or in the state capitols. There are many, and there will be more as public funding becomes increasingly important. Technological revolutionaries might well make recognition of diversity their first rule. Above all, there is great diversity of students: their backgrounds, their needs, their expectations.

Diversity of Students:

For years there has been talk of post-secondary education for every American, of "universal access" to study and training beyond the high school.

Now the action and the accomplishment begin to approximate the talk. As a result the demand or market for educational services is far greater and much more heterogenous than it was 10 or 20 years ago. And the processes of extension and differentiation continue. To obfuscate or gloss over the variety of students and their needs can only hinder the development of new educational technology. A critic of The Fourth Revolution, Joseph B. Margolin (1972), thinks "lack of attention to the basic principles of change" is a flaw of the report as well as of the educational process itself.

> ... The statement is made that it is well known that different students learn different things under different conditions. That this wisdom was available to the authors and was buried rather than highlighted is a sad comment on the priorities and emphasis of the Report which was much more concerned with at best uncertain guesses about the number of students and dollar costs of budgets ten years in the future. ...

Although the differentiation is neither clear nor simple most U.S. higher education -- its institutions, policies, and attitudes--can be categorized as either "Elitist" or "Mass". Massification, however, is the predominant trend against which elitism is on the defensive. Where "the torch of learning", erudition by old Ph. D. standards that is, still burns, the technological revolutionary may expect strong opposition. Of this more will be said later.

Open admissions and the thrust toward universal access have produced several types of students. In mass education institutions mainly there are the students Patricia Cross (1971) has called the New Students. These are young, lower-middle or working class students enrolled in two year community or junior colleges. They are new in the sense that the majority of their parents never went beyond high school, and they are a new type also because they score lower than others as a rule on

the usual measures of academic achievement. Cross found 78 percent of them below average in their high school grades. Analyzing data on a total of 66,200 high school and junior college students, Cross reports that they scored in the lower third among national samples on traditional tests of academic ability. Most are Caucasian, but a substantial number are from ethnic minorities. Most come from impoverished homes educationally as well as financially, but a fourth of them are the children of college-educated fathers. Sociologist Martin Trow (1970, p. 25) found these students "involuntary participants" in higher education because they are pushed beyond the high school. They are pushed by a scarcity of options, by the belief that there are no good jobs to be had without college credits, by social and political pushes like the draft was for many years, or by family expectations.

The second kind of students are the Elitists and Rebels (the latter a subdivision of the former), and these are found mainly in the elite institutions. Their orientations are more changeable than their dress which, incidentally, is no badge of student type. The elitists have always been there, the children of upper-middle class and upper-class parents, but recently mixed with a growing number of poor but bright students. Many ethnics are included. These students are enrolled in AB or BS programs which are occasionally experimental. They are potentially members of the learned professions, the civil service, the business and political leadership of the country.

The fifty state and private institutions of high quality that belong to the Association of American Universities are the most fully developed and widely recognized of elite institutions. As Trow (1970, pp. 2-3) observes, these universities are dedicated to the transmission of high culture, the creation of a new knowledge by scholarship and scientific

research, and the formation and certification of elites for the larger society. State universities in the elite category such as California at Berkeley, Michigan at Ann Arbor, Wisconsin at Madison, North Carolina at Chapel Hill, Texas at Austin and others, are required by state law to admit any and all who graduate in the upper fourth or the upper half of any high school in the state. But the faculty have ways and means of coping as they devise their own institutionalized evasions. They may make performance in the freshman year a kind of "de facto college entrance board examination," as David Riesman and his associates accurately observed (1971, p. 10). Large proportions, perhaps more than half, are flunked at the end of their freshman year. There is also compartmentalization of programs and students. Those seeking vocational and practical training are segregated from the elite clienteles who pursue liberal education and graduate work. There may be quite clear divisions of mission as between, say, departments in English and in Education. (Trow, 1970, p. 5).

The rebel in the elite realm is newly arrived on the scene. That is to say, in the last decade. He is a counter-culturist and though he earns credits as either an undergraduate or graduate student he/she rejects the traditional values of careerism, expertise, specialization and meritocracy. Trow observes that these students reflect "the enormous growth of higher education and of affluence that allows undergraduate interests to be pursued in graduate and professional schools." (1970, p. 28)

Some rebels are particularly avant garde. These middle and upper class sons and daughters not only revolt against institutionalized elitist values, but take up alternative life styles. So far as their

education beyond high school is concerned it is best described as unstructured and independent learning. Life "experiences" are highly valued. In This Way Out authors Coyne and Hebert (1972, p. 3) describe this kind of rebel elitist student as follows:

> This student is not concerned with corporate education; is not loyal to any one institution; is not interested in furthering technology. He/She scarcely accepts it. This student must contrive an education in the environment which has become a learning environment. It is this new kind of education that we call independent study.

Such formalization as there is of independent study is to be found as a rule in small innovative private colleges with high tuition charges. A high degree of personal motivation, flexibility and openness to new situations is required. One of our cases, Waxford College, is of this sort.

Third, there are the Older Students in search of new skills. Some are middle-age people in mid-career positions. Many are women who are returning to school. They are what the Illinois Board of Higher Education calls the Third Force in four year education. They seek a different type of education than do students enrolled in elite universities and colleges emphasizing graduate programs. They also seek different educational experiences than do those students in the unselective, multipurpose, four-year state universities that emerged from the old teachers colleges.

In establishing two upper-division "capstone" institutions for the state community college system, the Illinois Board wrote:

> Perhaps the majority of such students can be characterized as less theoretically and esthetically motivated and more economically and practically oriented than students in four year institutions. (1968, p. 33)

Jefferson University, one of our cases, serves a large population of older students with interests similar to the "Third Force" students.

Fourth and finally are the Forgotten Americans--children of the middle mass, many of them the first collegians in their families. They attend the multi-purpose, four-year mass education type universities. Many of these institutions were mere "teachers colleges" a few years ago. Today they are the newer state and regional public universities that Dunham (1970) called "The Colleges of the Forgotten Americans." Western Illinois, Northern Illinois, Eastern Illinois and Southern Illinois, Southeast Missouri, and institutions in "the State University" systems of California, New York, North Carolina, Wisconsin and other states -- all relatively unselective -- belong in this category. As Trow points out, their undergraduate departments are "given over largely to mass higher education in the service of social mobility and occupational placement, entertainment, and custodial care." (Trow, 1970, p. 5) Some students in these institutions might gain admission at "better" schools, but they could not afford the cost of residential education. Some of them are New Students of the sort previously described. A few are also destined for graduate work in the new multi-purpose universities. In some departments high standards of scholarship and research are maintained. Our case, Southeastern University is one of these unselective institutions.

Diversity of Institutions:

Having seen something of the diversity of students let us next look at the variability of the institutions that presume to serve these students. Fourth Revolutionaries will unquestionably need to vary their strategies according to institution type as well as student type. There are something like 2,600 post-secondary institutions listed by the U.S. Office of Education for the United States. (So poor are the statistics nobody can be absolutely certain.) Of the total about 1,000 were founded in the last 25 years, a fact that demolishes the public stereotype of

colleges and universities as venerable institutions that never die.

Among the numerous variables in the U.S. higher education scene, some are especially relevant to our purpose. First is educational mission or the principal program and course of study that characterizes the institution. There are three traditional categories of post-secondary education: two-year, four-year and post-baccalaureate. Then there is the non-traditional mission, a course of study whose admission standards offerings and objectives are unlike those of traditional institutions. For example: "open" university, adult education, independent study, and the like.

A second variable of practical significance for educational technologists is that of control and sponsorship: public and private on the one hand; municipal, state or federal on the other. Increasingly this distinction is blurred as the thrusts of government become more extensive. The private sector includes proprietary or profit-making institutions on the one hand; and not-for-profit institutions, the great majority, on the other hand. The latter, the no-profit, may be either sectarian or church-related. The public institutions may be those of a city, a special district, part of a state system, or state-autonomous. The parts of a state system may be branches with separate boards for their own campuses. Or their boards may report to a "super-board," especially in matters of budget and comprehensive planning.

Size of student enrollment and teacher-student ratio are two more important variables. Enrollment is usually figured as head counts made in the fall for official reports. Typically these exclude enrollees in non-credit courses taken in extension centers. Number of teachers or faculty may be difficult to figure. As a rule the count is regular full-time faculty

employees (or full-time equivalents) regardless of how their time is allocated as between research, teaching, administration or other duties. Part-time faculty may or may not include research fellows, technicians and others not engaged in teaching activities.

The Carnegie Commission has joined a number of institutional variables in their selection of different kinds of institutions for special studies. These include multi-campus universities, "invisible colleges" (small private colleges with limited resources), two-year colleges, (actually an amalgam of vocational and general studies in different mixtures and emphases), Protestant colleges, Catholic institutions, state colleges and regional universities ("colleges of the forgotten Americans") and the formerly all-Negro colleges who benefit from the United Negro College Fund.

Finally, there are the post-graduate and professional institutions. These are mainly schools of technology, law, and medicine. Most are university affiliated, but some (like Cal Tech and Rensselaer) are autonomous. MIT, originally an institute of technology, is more and more a university.

Special note should be made of the agricultural colleges formerly the "A and M" schools that were established pursuant to the Morrill Land Grant Act of 1862. Most of these have been upgraded to state universities and in some cases like, Wisconsin, Illinois and Ohio State, the principal state university has always encompassed the agricultural and mechanical colleges.

Diversity of Associations and Lobbies:

At One Dupont Circle in Washington, D.C. stands the National Center for Higher Education, a ten story office building that houses scores of special interest organization offices, all in the higher education field. The building was constructed about five years ago by the American Council on Education which is composed of some 1200 associations and individual

institutions. The announced purpose of the ACE is "to advance education and educational methods through comprehensive, voluntary and cooperative action on the part of American education associations, organization and institutions." Founded in 1918, the Council up to now has not been known for its comprehensive success, however, when it comes to Washington lobbying. Studies and position papers have been numerous, but the sheer variety of the Council's membership together with the persistent apathy of many sectors when Congressional action is at stake have prevented the Council from speaking with anything like a single voice.

The list of ACE members reveals the variety of institutions and interest groups. First, there are the "constituent organization members" -- 81 of them. These are classified as groups "A" and "B". The former consists of eight nation-wide associations of Junior and Community Colleges, State Colleges and Universities, American Colleges, American Universities, Jesuit Colleges and Universities, Urban Universities, State Universities and Land Grant Colleges, and the National Catholic Educational Association. Group B includes the regional accrediting associations, scientific and learned societies, and a variety of special interest associations such as college women, osteopaths, dentists, theologians, law schools, medical schools, and so on. The largest category of ACE's membership is the "institutional members": individual colleges and universities in all of the 50 states, the insular possessions and the District of Columbia. Finally there are the "affiliates" such as the Brooklyn Public Library, the American Bankers Association--Education Group, the National Association of Trade and Technical Schools, the Salk Institute for Biological Studies and the Sears-Roebuck Foundation.

Unitary positions on the part of so varied and large a population can hardly be expected. About all they might be expected to agree on is the

goodness of education and the evil of ignorance. Nevertheless, it is possible that on questions of the new educational technology some groups may take a stand. Our interviews with a sample of executives from the national associations and officials of the U.S. Office of Education, plus consideration of the variables already discussed, permit some guesses as to what lines might eventually be drawn, and where forces for innovation and constraint might be generated.

Considering mass and elitist differences, the comparative power (constraint) of faculties vis-a-vis administrators and external control groups, and our own interview data, we present below an estimated ranking of national associations (group A, ACE members) according to their likely receptivity to the new technology---(1) the most, (8) the least.

1. American Association of State Colleges and Universities
2. American Association of Junior and Community Colleges
3. National Association of State University and Land-Grant Colleges
4. Association of Urban Universities
5. Association of American Colleges
6. National Catholic Educational Association
7. Association of Jesuit Colleges and Universities
8. Association of American Universities

Among the group B associations there is one that should be highly receptive if costs of instruction by electronic means are proven to be less. This is the National Association of College and University Business Officers. But any pro-innovation position there would probably be opposed by the American Association of University Professors as well as by other guilds or unions of teachers. The majority of the group B national associations, however, would likely be receptive to a "Fourth Revolution." For example, the Association of Medical Colleges is composed of those professional schools which may already be utilizing closed circuit television and other devices the most. The American Library Association has considerable interest, of course, in the evolution of "learning centers." And the Association of

University Evening Colleges, confronted by increasing admissions and costs of continuing and adult education would seem receptive. The likely positions of other collectivities in the ACE's Group B can also be assessed, though not in this paper. In any case, Fourth Revolutionaries would do well to keep themselves informed as to the deliberations and actions of those associations which are likely to figure in the outcomes of their pro-change efforts. More of this in Part Four of our report, "Build Innovative Networks."

Part Two

LEARN FROM EXPERIENCE: FOUR CASE STUDIES

Let us shift attention from the national higher education picture, with all its heterogeneity, to more fine-grained observations of the Fourth Revolution in particular kinds of institutions. This we shall do on the basis of four case studies, supplemented by previous studies of electronic instructional methods in academe. The four cases we selected are all in the Midwest region: (1) the Rivers Junior College District (mass, two-year, public); (2) Southeastern University (mass, four-year plus, public); (3) Jefferson University (mass, public, large population of older students and junior college graduates) (4) Waxford College (elite, four-year, private).* All four cases were reputed to be change-prone, open to new ideas, and with experience in the new instructional technology. Indeed, this was one reason we selected them. What we found did not always bear out the advance notices.

1. Facilities and Usage

Of our four cases, Waxford has the most hardware, the least usage, and the longest history of electronic effort. The "Instructional Resources Center" was built in the 1950's as a total education concept. It is a modern building with offices, library, auditorium and classrooms in which are included large booths at the rear that remind one of the smaller projection rooms of moving picture theaters. Some of these booths contain two or three movie projectors, several tape recorders, several television monitors and equipment for making video tapes. At the front of the larger classroom is a cumbersome and elaborate console from which the teacher can control everything in the equipment room, adjust television screens, use the overhead projector, etc.

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* All names are fictitious for reasons already noted.

A problem with which the innovators at Waxford have had to contend is that the head librarian, a man with many years of service, does not agree with the "instructional resources" concept of a library. For this reason the technological aspects of the Instructional Resources Center are administered by a department separate from the library, but located in the same building complex. The head librarian will retire soon, and Waxford then plans to mesh audio-visual and library services administratively in the manner which is becoming increasingly common in education.

In addition to the classroom-booth facilities, there are studios for television production, and a closed-circuit television network throughout the Instructional Resources Center. There are facilities for producing slides and A-V tapes, and five portable Sony video cassette recorders which can be moved about the campus enabling students to make TV films. Five larger units on hand carts are said to produce a clearer film. Finally, there is a well equipped stuido.

The expensive and elaborate hardware appeared to be little used at Waxford. In five classes we saw not one teacher using A-V or telecommunications. Two teachers (math and biology) were using their blackboards extensively. Our informants reported little use generally of the new techniques. Why? The dean who had been mainly responsible for Waxford's technology pioneering had concluded that programs made elsewhere and imported ("pre-canned" programs) do not work. He said,

> Transplants have little chance in education. Students must have some kind of contact with an indigenous system. The telewriter and amplified telephone response systems are good because they give students the feeling that they are in direct contact with the person--guest lecturer or interviewer--at the other end of the line.

As for closed-circuit TV, this made little sense at Waxford because, said one respondent, "We have such a low faculty-student ratio that we just haven't needed it like a large institution with big classes might. But then maybe we haven't been very inventive about new ways of using it either." There was only one professor making intensive use of A-V equipment. He was a teacher of physics and chemistry who sought to use his time and the students' time with maximum efficiency. Therefore, he considered regularly the technological alternatives, and incorporated them wherever possible. He rejected pre-canned programs but liked to make his own demonstration programs, for example "How To Work With a Slide Rule." He said,

> It's very difficult to hold a slide rule up in front of a class and it's difficult also for the student to hold their own slide rules while they watch a demonstration. On film you can zero in on the slide rule that is being manipulated and that's very effective.

The extensive A-V user said he does not use the big consoles in the classrooms, because he prefers to use the manual controls for a 16mm projector or an overhead projector or a slide carousel at the back of the room. As for the closed-circuit TV, he found almost no programs (software) suitable for his classes in physics and chemistry.

In the Rivers Junior College District, which only began in the middle 1960's, new technology is emphasized, especially in the career/vocational programs. These include, for example, secretarial science, dental hygiene, x-ray technology, auto mechanics. There is a Department of Instructional Resources whose mission is to promote and facilitate the use of closed-circuit TV, a large audio-tutorial system, and audio-video cassettes. While there is no CAI in the District, the computer is used extensively for information retrieval. Library cataloging and indexing is fully

computerized. A new position called "Systems Librarian" was recently created; its purpose to provide an interface between teachers and instructional resources, including the library.

At one of the District Colleges 80 percent of the students test below the 50th percentile in reading ability on national 12th grade norms. Audio-visual instruction is emphasized and promoted by an A-V staff of 12. Most of the ideas for technological innovation come out of this staff. In the summer they conduct extended-time workshops with the faculty to get more technology into their teaching. The plan of the college is to add equipment until every classroom can produce and receive TV. But administrative personnel emphasize that this too is used in conjunction with a policy that not all classes will be taught through television. Students have low attendance rates for regular classes, and it is assumed that if classes were taught by TV the figure would drop even lower. However, a televised class in law enforcement produced for the local police department went over very well at the precinct stations. was unnecessary for policemen to go down town to the police academy to get their credit. Also, a two-semester course in history presented by television has gotten favorable results.

Two large lecture halls at the District College are equipped with response systems and consoles at the front of each room. However, there have been so many equipment failures in the response systems which, in turn, have caused all other A-V equipment in the rooms to fail, (since the systems are inter-connected) that the response systems have been disconnected. Both here and at Waxford it was thought that the teaching techniques to accompany response systems have simply not been developed. At the Junior College, for example, only one instructor used them for purposes other than taking attendance.

At Southeastern University about 40 percent of the faculty are reported to use A-V equipment regularly. There are overhead projectors in many classrooms on the campus. In an hour or so any teacher can also procure other equipment (slide carousels, 16mm projectors, tape recorders, and record players, etc.) from the Resources Center. An experiment with amplified telephones in which a philosophy instructor confined to his home with a broken hip tried to teach his class did not work well because there were too many equipment problems.

The director of the A-V Department of Southeastern University thought many teachers treat new technology more like a toy than a useful piece of equipment. When the magic or novelty wears off they stop using it. But an instructor in earth science has regularly used portable cassette-making equipment on summer field trips. He and his small groups of summer students have taped their entire field trips. Back in the classroom there is much interest in such programs because all of the students can see their own peers working at the field sites.

A dial-access video center was planned for students at Southeastern. There would have been 60 carrels with A-V equipment and tape decks; and students would have been able to use the carrels for dial retrieval of lectures and supplementary materials. A micro-wave hook-up was planned between the campus and a nearby campus where the dental school is located. The total installation would have had 24 channels and would have cost about $500,000. The development of this project was halted by the bankruptcy of an east coast company that was to have provided the installation.

Jefferson University serves students from junior colleges as well as many older adults seeking credentials for advancement. It is a relatively new institution with a mandate to be innovative. The verbal aptitudes of these students are low, and therefore the quality of teacher contacts are especial-

ly critical the administration believes. There is little confidence in CAI. Few administrators or faculty are even interested in total computer utilization for instruction and most of these are in areas of professional associate ("para-professional") training such as medicine or law. Classes at Jefferson now average 27; up from 24 a few years ago when the University began. Teachers must often work to counteract the pressure to lower standards. Although the controlling board has ruled out remedial courses, they are given nonetheless on an individual basis because they are necessary.

One of the librarians at Jefferson said she thinks every member of the faculty makes some use of the new technology. A few use it much more than others. It is easy to make use of technology there because the equipment is new and in excellent condition. The library at Jefferson has been renamed an "Instructional Development Center". The near-open admissions policy, combined with the low verbal aptitudes of so many students, leads instructors to seek all resources at their command, including technology, to overcome these difficulties.

Despite the official mandate assigned Jefferson by its Board (open admissions plus innovation), and despite the characteristics of their students, the president seems to be an educational traditionalist. The model he enunciates resembles the general education schemes at the University of Chicago and at Montieth College of Wayne University. Yet a number of faculty have rebelled and been denied tenure recently because they did not agree with the direction the school was taking. Just how these general studies and liberal arts concepts will be meshed with programs for sub-professional occupations and careers is unclear. However, inasmuch as the legislature only authorized Jefferson University in the spring of 1969, with first admissions in 1970, the institution is no doubt still searching for its image and identity. There are 2400 students--13 percent work, mainly

in civil service or public schools. "Hard" educational content is thought to be less important in the jobs they now hold, or aspire to, than is the advanced degree and certification per se.

What will happen to the revolutionary receptivity at Jefferson University in the future? When the president at the beginning wanted an FM station that would be utilized for non-traditional studies, the Board turned him down on the grounds that all of Jefferson State was supposed to be non-traditional. The original Board had five Ph.D.'s with academic experience, whereas the present Board now is composed mainly of business men and lawyers with only one academician. Though Jefferson University has just opened bids for a small computer system like the Xerox 530 to be used chiefly in the mathematics and computer science training area, the planner told us that when he asked the over 100 faculty members to indicate ways in which they might make use of such a system he got not one reply. As a matter of fact, in his own teaching the planner makes little use of technological equipment because it is "just too much trouble to use." He said he got into this habit while teaching at the University of Connecticut where the use of technological equipment was hedged about by many bureaucratic rules.

In the past year especially some of the innovative bloom at Jefferson University has faded. Courses which were once numbered and listed randomly are now sequentially numbered and listed alphabetically in traditional academic fashion. Eight disciplinary programs and four interdisciplinary program areas are now grouped into "clusters" that resemble "schools" and that are headed by deans. Other differences between Jefferson University and traditional institutions are decreasing. What began as an assembly which was an experiment in "participatory democracy" for academic decision-making is rapidly losing power to traditional administrative machinery with formal accountability to the President and through him to the Board.

2. The Production of Application Software

"System software" is the instructions or codes that serve to direct an electronic system, computers included. Some of this comes with the hardware and some may be developed by local staffs. "Application software" includes programs which, put into the computer or into other machines gives performance or substantive content. It is application software to which we refer here. And it is application software that is commonly either non-existent now, or of such poor quality that it has evoked much criticism of computer technology in education. Indeed, this software condition is said to be the reason why the new technology is not used more.

Generally, we found little production of software at the institutions we visited. Few A-V tapes are made at Southeastern because the A-V specialists must depend on the faculty to make them. A larger budget would be needed to send the specialist to help the faculty. Anyway, if one seeks to help a professor this is apt to be seen as interference, as trying to tell the faculty how to do their jobs. Most of the tapes that have been produced by the faculty are pretty bad, the A-V people think. Each teacher comes on with his own lecture in his own specialty. Rarely is the result either artistic or engaging. The head of the A-V department said he had learned three things about professors making tapes; 1) scientists do not make good actors, 2) teachers do not make proper use of the technology to give variety to their instruction, 3) courses taught solo via TV by faculty when they do not operate "as a team" are boring.

One of the major difficulties in the "indigenous production" of application software was said to be the lack of a theory of instruction that encompassed both hardware and software options in reaching a well-defined

audience of students with a few educational objectives clearly in mind. There was reference to an open community college at Bloomfield Hills, Michigan as an example of a school in which the theoretical dimension has been emphasized in its technological innovations. According to the vice-president of Waxford College, Oakland Community College is a vocational/technical institution that does an excellent job of utilizing technology. They make use of small tape units with particularized tests built around quite specialized subjects as, for example, the grasses of the middle west. Such small unit subjects have been so successful that Oakland is now marketing them in the form of audio cassettes.

Robert Nuney, the man chiefly responsible for the theory behind the Oakland development, assumes that the instructor needs to know where each student is and how he is at the beginning; that everyone has his own preferred way of learning; and that learning should be pleasant. Accordingly, students are extensively tested at the beginning of their career at Oakland. This battery of tests is then coded into a computer. The result is a "cognitive map" of the student. Instructors are similarly examined, and an attempt is made to match instructors with those students whose cognitive maps resemble theirs.

In the area of preferential learning a lot of technology fails because it is mistakenly assumed that everyone can learn by the same method. And the hardware and software then treat all students the same. Also, students come to colleges with fixed expectations as to how they will learn. These are traditional for the most part, so that when a student encounters technology he thinks that he is not getting what he should get in college.

The producers of good application software were said to be people who work from a theory of instruction, not merely with machinery. If

machinery is thought to be of prime importance, then the proper philosophy for good software production is simply impossible. At one institution near Chicago a very high-powered man was given an elaborate media system to work up. He did this, and then departed, leaving the college with nothing but machinery and no educational residue of learning theory as to how it could be made to work. The importance of indigenous production of application software is underlined by the fact that nearly everyone we talked with had found transplants or pre-canned programs ineffective. In the elementary schools teacher reaction to such programs as "Sesame Street" and "Electric Company" has been quite different, it should be noted. Nor, for that matter, doe every college teacher write his own textbook!

3. CAI Evaluated

As we have seen in the preceding sections of our report many teachers and administrators at the institutions we visited take a dim view of various modes of the new technology. But none was evaluated as negatively as CAI--computer assisted instruction. For that reason and because of the widespread interest in CAI in some quarters, we consider it separately here. Note, however, that there has been almost no CAI in the St. Louis region; a reason perhaps for the negative reaction that we found. One dean was apprehensive about the PLATO system. He feared that there is no way now that the further development of this large system can be reversed. State and federal governments simply had too much invested in PLATO and similar large systems to let them fail. To avoid "egg on the face" a place must be created for them in higher education even though, he believed, PLATO and similar large systems have nothing to offer in many settings. In the dean's judgment the principle of large system suitability is simply that the more general and less specialized the learning, the greater the suitability of large system CAI. From grade school to large freshmen-year courses in big universities PLATO and similar systems may very well have a place. But no further.

Another man, the director of a computing center at one of the institutions we studied thought that a large system works best when it is used for standardized or competitive learning activities; for example, in elementary language instruction with frequent drill and practice sessions. In fact, however, little is known about what is best taught by the computer. Teachers who can learn complex systems and then translate them into teaching have been the only really effective users. For the rest, the software needs to be developed that will make it possible for all instructors to readily understand how to utilize the computers in their particular subject matters. So far it has been the more technologically experienced people who have best understood how to use the computer systems. Large systems were said to be the play things of little groups of instructors.

Wide publicity has been given computer simulation, decision making, and gaming. While realistic complexities are thereby taught to some degree, one faculty member noted that students may be led to think there are single solutions or outcomes when in fact they may be numerous.

> Some of this modeling by computer produces a kind of rigidity that ought not to be encouraged. No matter how much branching and corresponding flexibility there may be in a computer program, unless the student is aware of the range of the possibilities he may conclude that the path he chose is the only answer in a complex situation.

The centralization of computer operations in large systems makes the user feel isolated from the work that is being done. It was observed that resistance to centralization of academic computers is the consequence of the user's desire to feel in control of what he is doing. Where small colleges can afford it, they may well choose to go on their own with smaller systems in order to maintain their independence and to provide a sense of control for the users.

The advantages and disadvantages of time-sharing vs. batch processing need to be carefully weighted, it was noted. A time-sharing set-up like Project Impress at Dartmouth College entails a trial and error method of reaching answers by the user. On the other hand, batch processing compels the user to examine his own thought process as he tries to run a specific program through the computer.

One of the difficulties with computer utilization is that so many people are afraid to try to understand the machines. It is even difficult for them to accept computer results that have to be read on simple microfiche readers. A lot of this may be due to the computer technologist and the manufacturers of the hardware who have failed to make their products more easily or more widely intelligible. "Too many people in computing centers and people associated with the manufacturers tend to be production-oriented", as one informant put it. He meant that they have not thought about the users as much as they should, nor recognized that intelligibility of the output is often hard for a non-technologist to comprehend.

A number of observers emphasized the well-known fact that computers are more often used in physical science than in social science and humanities. It seems that in subject matter areas where the instructor can state the dimensions of the problem and his purposes in detail, and can specify a limited number of outcomes clearly geared to course content exactly and explicitly stated, then he can use the computer. This is more frequently the case in the physical sciences. It may be that in the social sciences "the computer is only appropriate as a tool and almost never as a teacher." Premature forcing of hard and fast answers or contents that can be computerized entails the risk of freezing subject matters and learning into machine

molds. For social science to be taught in this manner would likely be disastrous, our informant thought.

At Southeastern University we found an educational psychologist in business administration who had developed a course around a data bank that was evidently quite effective with a large number of students. But it was not computerized. The professor described his program as problem oriented and featuring minimal contact between students and faculty. Therefore, it is suitable for off-campus programs and for part-time students. The principal goal is to develop concept formation in the students. This, the instructor believed, will lead to a higher level of thinking than does the ordinary content course. The program is based on real problems that are to be found in the local metropolitan economy. For solution of a problem the student is referred to a non-computerized data bank that contains detailed demographic, social, economic and financial data on, say, a real estate development, a business firm, or an industry. Students submit written questions to the operators of the data bank who retrieve the information for them. They use the data to develop ideas and to write reports on the problems which have been selected because their effective solution demands interdisciplinary concepts, techniques and knowledge. The process of learning moves to concept development to information search to feedback and back to modification of concept. During the one year operation of the program four studies of knowledge acquisition using control and experimental groups, had been made. They showed no difference in the amount of knowledge acquired by the experimentals and the controls (students in the regular business program). But the experimental group scored significantly higher than did the controls on conceptual ability. They also showed significant increases in achievement motivation and in the ability

to compensate for the 50 to 60 percent reduction in student-faculty contact time. Several publications have come out of the research, and the program has been observed by numerous educators and scientists from elsewhere.

Students at Waxford in a course with CAI were said to be "so confused" by the machines they could not use them. In the Rivers Junior College District only the accounting and mathematics programs used computers--desk top type. It was thought that CAI would not be suited to their students generally. At Jefferson University a few students learned to use the computer, and they lost their fear and animosity toward it. Most students were said to hate it, perhaps because they do not understand it.

Given the nature of the humanistic disciplines, the presentation of entire courses by data bank or by CAI with little or no teacher-student interaction would change the focus of teaching. Phyllis McDonald, (1970, p. 124) a teacher and educational researcher, notes that "computer systems are based on efficient, rational thought, and strict rationality is not always conducive to creative thought." Russell P. Kropp, an educational researcher with first-hand knowledge of CAI development writes,

> A major characteristic of the methodology used in developing course materials for CAI presentation is the painstaking analysis and reanalysis of content, presentation technique and component learnings into their elemental particles. Hopefully, these atomistic bits can then be structured serially into a meaningful instructional sequence which transports the student unerringly to the instructional goal with the same economy and efficiency with which a perfectly shot arrow traverses the distance between the archer and the bulls-eye. (1970, p. 212)

However, the teacher who seems to be fumbling and inefficient in fact may be more necessary to the student than is imagined.

> The whole point of education might be missed if curriculum development were given over to non-educators. Through slavishly pursuing a methodology of reductionism and a goal of cost-efficiency, non-educators might seize the most superficial goals of instruction because they are the most amenable to currently available tools and techniques. (p. 213)

Kropp says his comments were made with extreme reluctance (p. 212), since it is likely that they will be misinterpreted. Although he was talking primarily about computer use in public school systems, his cautions we think are applicable to the use of CAI in humanistic disciplines in higher education.

At the same time it seems likely that computers will have wide application in drill and practice in language or other areas where content goals are very specific. At the same time, the information retrieval capacity of the computer will be of tremendous value to students in the social sciences. In higher education it is probably that the development of large systems with different philosophies will lead to assessment of the proper role that computers can or should play vis-a-vis certain student population. Despite some of our informants' opinions to the contrary, the PLATO system emphasizes the role of the teacher in designing and monitoring courses. A major component of its software program is the TUTOR language which allows teachers to design courses and to intervene and monitor in courses which are pre-planned with a minimum of knowledge about the computer. Allen Hammond (1972, p. 112) comments that

> The PLATO approach is an attempt to improve the productivity of teachers rather than to replace them, an approach that may meet with less resistance from the educational community than that of the TICCIT approach.

TICCIT instructional materials are designed, pre-tested and programmed by "teams of specialists."(p. 110) Students are offered several ways of approaching the material, by which method the TICCIT developers hope to give the student control over his own learning process. Initially, the

programs will be tested in junior colleges where, it is hoped, they will be able to take over as much as 20 percent of the teaching load. (p. 111)

Project Impress at Dartmouth uses a different approach then PLATO. Impress has taught students to use the computer as a source of information and also to use it as a sophisticated tool for lengthy calculations. Dartmouth has had several years of experience in exposing its lower division students to the awareness of the capacity of the computer as an adjunct to learning in both the hard and social sciences. John G. Kemeny (1972, p. 79), President of Dartmouth, finds that an unintentional spin-off of the exposure has been of particular value. That is, students in many cases have written their own programs. This makes the student the teacher and the computer the student, as it were.

Part Three

ENCOURAGE INNOVATION, CURB CONSTRAINT

Administration as a Force

The faculty tends to be the principal constraining element in the use of technology once it is a real option. But it is the administrators who are the gate-keepers when it comes to the innovation of technology into most institutions. As the executive secretary of the Committee on Non-Traditional Study observes,

> Almost always there is evidence of strong leadership, in some strategic place, most often an administrative office, seldom a faculty senate or committee. (Valentine, 1972, p. 10)

In those schools where administrators avoid initiating changes, innovation may come from faculty and departments. And should a change perchance be initiated by administrators under these circumstances, the faculty will likely oppose it. Where organization is hierarchical, change tends to be originated by administrators and to filter down. (Evans, 1967, p. 132)

A survey in 1971 of about 1,000 colleges and universities established since 1947 found their presidents stressing the accumulation of library collections at the expense of the new instructional technology. (Demerath, 1972, pp. 86-87) When it came to helping the great numbers of students who are nonverbally oriented, the presidents were noticeably less concerned and less innovative than they were with the book and word minded. Table I shows the extent of utilization of instructional technology in all the institutions responding to the American Council on Education survey. The high percentages indicating only "moderate"

TABLE I

Utilization of Instructional Technology*

Techniques	Presidents' Responses (Percentage)** Very Extensive	Moderate	Little or no
Motion Pictures	18	55	8
Radio	2	14	61
Audio Tapes	22	47	11
Teaching Machines	5	18	53
Closed Circuit TV	3	12	60
Broadcast TV.	1	11	63
Language Laboratories	34	23	21
Computer-Assisted Instruction . .	4	7	64
Dial Access systems	3	3	67
Computers for research.	2	14	59

* From New Academic Institutions: A Survey, p. 86 (Demerath, 1972)

** Because of non-responses or multiple replies, columns and rows do not total 100 percent.

and "little or no" utilization probably reflect the teaching-as-usual preferences of most faculty members as well as the presidents' own predilections. No significant difference in use was discernible between public and private or between large and small institutions. The finding from these data was:

> The only technique used "very extensively" by as many as a third of the new institutions was language laboratories. Combining extensive and moderate usage, motion pictures are the most used, audio tapes are second, and language laboratories third. Least used are four techniques with great potential for individually paced learning and for wide dissemination of the best teaching: dial-access systems, computer-assisted instruction, television, and teaching machines.

In assessing the attitudes of administrators toward technology, their unique position as mediator between controlling boards and students and faculty must be taken into account. At a private college with a "very" cooperative" Board of Trustees where there had been a large investment in technology in the 1950's, administrators were chagrined at their technology's ineffectiveness as a classroom tool. They blamed this partly on the resistance of the faculty, but one of them commented, "Perhaps we haven't been very inventive about looking at new ways of using it." This college, Waxford, has turned almost completely to innovative programs that emphasize free curriculum structure and course content. Both administrators and faculty thought this was what the students wanted. The Dean of Faculty said the administration would be "totally uninterested" in any large investments in technology now or in the foreseeable future. The College's big selling point now is a new "three year modular curriculum".

The President of a small, new innovative public university,

Southeastern State, said that some of the recent changes of a traditional sort were due to pressure which the state board brought to bear. He thought that the boards of private universities are more often sympathetic to the attitudes of both administration and faculty. His state board seems to place an inordinate emphasis on costs now, although when the school was first opened things had been different. Then his board had five educators on it and the cost problem was not emphasized to the extent that it is now when the board is composed mainly of businessmen.

Costs, of course, are a major interest of administrators both public and private. And some administrators we talked with thought that the new technology would be a costly gamble against a chance that it would not be effective. They were in schools where closed-circuit TV had been tried with little or no success. Therefore they are opposed to further outlays in the face of little student and faculty interest.

Several of the non-traditional study ideas now being pursued by some institutions would nevertheless entail greater costs because they would increase the amount of personal faculty-student contact -- unless there were compensating cost reductions. Also, as with any type of innovation, initial costs of development are especially high. The Open University in Great Britain, for example, has encountered start-up costs amounting to tens of millions of dollars. Whatever the economics of the Open University may be, the Vice Chancellor, Walter Perry, has emphasized that economy was definitely not a motivation behind this experiment. Nelson (1972) comments that

> This is in direct contrast to the motives behind much of the interest in new degree programs in our own country. In England, the primary motives were to provide quality higher education to the vast number of adults who had been denied a first chance and to harness the new technology in order to stimulate genuine innovation in the means and forms of higher education. (p. 13)

On the other hand for some public authorities the new technology promises to mitigate some of their tremendous cost problems. The Carnegie Commission (1972) in The Fourth Revolution predicts that:

> For financing authorities, the new information technology will eventually reduce instructional costs below levels possible using conventional methods alone, but in the short run, it will only increase costs. (p. 3)

There is some evidence that the eventual cost benefit which technology promises for higher education has been projected by public boards and legislatures to all non-traditional study. Hartnett (1972) comments that:

> ... many legislators are betting on the non-traditional programs to yield the same or more social good for much less money, a factor which no doubt explains the enthusiasm for non-traditional programs in some states. Until or unless they are proved wrong, many politicians and some educators will continue to support non-traditional educational programs primarily because they are convinced that such programs are cheaper. (p. 17)

Administrators at public institutions appear no more enthusiastic about new investments in technology than those at private schools. However, they are forced to contend with public boards and legislatures. Some state systems, like Illinois with its PLATO project at the University of Illinois, have invested in the development of large technological complexes. They will expect to see results, and they may be expected to exert pressure on institutions of higher education within their authority to introduce such innovations.

Private administrators in post-secondary education could probably be enticed into experimenting with technology in spite of the lack of enthusiasm they express. The greatest pressure that private schools are feeling in the early 1970s is financial. The creation of centers for promulgating the new technology as recommended in The Fourth Revolution and the expenditure of large

federal funds would no doubt influence the extent to which private institutions experimented with technology.

In Resistance to Change In Higher Education, Evans (1967) comments that there is some evidence that university budgets do not provide mechanisms for change.

> "Basically, we would hypothesize that the economics of the university system and the entire budgeting procedures too often appear to be dedicated to maintaining the status quo." (p. 132)

Of course administrators cannot go far with innovations unless the faculty cooperates. Faculties, especially at "the better institutions", regard administrators as bureaucrats and natural enemies, therefore academic officials are unable to exert much authority in day-to-day academic matters over the professionals whom they supposedly control.

On questions of instructional technology, Levien (1972) notes that deans and department heads are more likely to be in accord with the faculty than they are with higher level administrators. Cost-effectiveness is less important to them than hiring and keeping good teachers and scholars. They are more responsive to the faculty's wishes in the allocation of resources too.

If boards and presidents put up buildings and incorporate technology in them unilaterally they must then confront the task of persuading their faculties to use them. We saw this quite clearly at one school we visited. A learning center with every technological device available at the time had been built at great cost some years earlier. Nevertheless, in classroom after classroom we saw classes being taught in the traditional manner. The teaching devices were pushed against the walls, and the instructors were making extensive use of the blackboard.

Faculties have tenure, and they also have that amorphous weapon termed "academic freedom." They have direct access to students, a group which tends to side with them in any direct confrontation with administrators. Students and faculty alike share a distaste for bureaucratic controls in the modern American university.

Although there are disagreements and conflicts within departments, in the long run the members of any given department are more homogeneous than the university as a whole, as Martin Trow points out. The extent to which administrators alone can incorporate technology into any given university situation is limited by the unique structure of that complex organization--the modern university. As Trow says, (1970, p. 31), "...the department, rather than a college or the university, [is] the unit of effective educational decision."

One faculty dean at a small college told us that he had just worked for ten months to gain faculty support for a Three-Year Modular Degree Program. He had gone from one professor to another "selling" the idea like a door-to-door salesman. Such an approach would be difficult, if not impossible, for a single official trying to innovate such an extensive change in a large institution. Perhaps the only feasible way for the administration to innovate technology in large institutions is to organize a unit whose job is just that and whose personnel are in effect "door-to-door salesmen"or "extensive agents" to the faculty and their departments.

In its "Recommendation 3" The Fourth Revolution suggests that responsibility for the introduction and utilization of instructional technology be placed at the highest level of academic administration. Deans of undergraduate instruction should provide the faculty with

information on technology. They should arrange training sessions and provide liaison with sources of financing. Officials of the institution should see to it that technology is readily available. Many faculty told us that they encountered so much red tape trying to get technology into their classrooms that it simply was not worth the effort.

The Carnegie Commission (1972, pp. 50-51) further recommends that adequate professional assistance be provided to faculty. In institutions we studied the enthusiasm and competence of the director of audio-visual resources and the quality of the A-V staff seemed to be quite important in inducing faculty to make use of technology. The idea of an Instructional Resources Director or A-V Director with Department-head status is relatively new in higher education. It seems to hold promise as an administrative mechanism in persuading faculty to utilize technology.

A university president told us,

> Innovation is now the thing in the federal government and at the foundations. There is such a push to promote the new technology that a large grant market has been created. Innovation is where the money is in higher education; but for the innovation to be successful we have first got to get rid of the snake oil salesmen.

He went on to say that any institution that would more fully exploit the new technology must move its reward system around so that good teaching is restored to its proper place. "As it is now, the authority of the teacher has been destroyed."

Several other administrators commented on the importance of encouraging and rewarding innovation by teachers, not least their production of application software. Only one individual, a professor, made the case for research-mindedness as a positive factor in innovation.

> Instead of talking about people dedicated to teaching instead of research, it is the researcher who should be recruited into the innovative program as a teacher because the innovating teacher alone is seldom rewarded for his teaching. The researcher who turns to the development of technology-based programs can publish, however. That is the reward of scholars and scientists. Furthermore, faculty who are research-oriented cannot be pushed around by department chairman.

Mere teachers and non-scholars who cannot go to jobs elsewhere because they are not known will not innovate, this man thought. It is they who are easily scared and, "If you are scared you get unionized and routinized." The individual who spoke thusly for research and development as tools of innovation was in trouble because his work had attracted national attention. This had created jealousy in several departments that were involved in his program.

The Faculty's Role in Innovation and Constraint:

Whether as teachers, as researchers, or as "R and D" people, the potential of a faculty to promote or constrain the use of technology cannot be overestimated. After all, it is the teachers who must utilize any instructional innovation, and it is their attitudes that will be an important determinant of student acceptance and utilization. It is the faculty who provide most of the personal contact between the student and the institution. McKeachie (1962, p. 69) found that "...one of the most interesting outcomes of the studies of student attitudes toward television instruction is that they tend to reflect those of the proctors in the viewing rooms."

As we have already seen traditional autonomy of college-level teachers makes it difficult, if not impossible, to impose on them changes with which they are not in agreement. The attitude of many faculty members is probably the principal social constraint that promoters of technology will encounter.

Our interviews elicited many comments by administrators as well as faculty testifying to the conservatism and restraining influence of teachers in the four institutions we visited. One man put it that there are two schools of thought among teachers. First, there are those who are simply unaware of educational technology and have no idea how to begin to use any part of it. Second are the faculty who are hostile and opposed to technology in the belief that in any shape or form, it is bound to infringe on their autonomy. The second category includes teachers who think that no matter what instructional technology may offer, they can do it better. Then too, there are many teachers who when they try to use a new medium find that it takes so much planning and time that it becomes a burden and makes their job more difficult, not easier. Teachers, like anybody else, tend to take the easy way out.

James Koerner (1973, p. 44) points out that resistance to the use of technology in education gets stronger as one moves up the education ladder. In post-secondary education technology evokes attitudes that "range from apathy to hostility." This is the result of the lack of incentives, and of the faculty job-market which makes it unrealistic to expect faculty to be "aglow with the desire to develop a technology of education that may eliminate jobs."

A further problem with the individual faculty member will be the difficulty of promoting the use of materials developed by outside sources or within large systems such as PLATO or TICCIT. In a study for the National Science Foundation, Anastasio and Morgan (1972) found that at the university level,

> ...one should expect intense interest in local determination of course content; no professor at a major university is likely to consider himself less competent to design curricula than any of his colleagues, nor will he ever agree entirely with a curriculum prepared by somebody else. (p. 39)

At the same time it is the large scale telecommunication systems which are of greatest interest to the advocates of non-traditional study by non-traditional instructional media. The "cottage industry" and each teacher on his own approaches are clearly opposed to the view that networking and distribution on regional or national scales are desirable.

Faculty as individuals have interests that constrain the advancement of technology in three ways: (1) Advancement and mobility. Faculty advancement in most institutions is presently based on publication. To enthusiastically embrace technology, they would have to use time now spent on publication on the development of instructional materials which do not go beyond their campus. This would restrict their mobility within the discipline, and at present is not even a rewarding activity in individual schools. Professional recognition of publication of innovations, widespread dissemination of technological developments, and local rewards for participation are ways in which the present system can be overcome. Only the latter is possible at a single campus. The first two require discipline-wide changes. Even at schools where teaching is emphasized over research, the load is so great that faculty have little time to develop instructional materials.

(2) Independence. Levien (1972, pp. 538-539) in a study for the Carnegie Commission comments that:

> The implication for instructional computer use is that faculty members are likely to be more willing to adopt a use in which they retain some measure of independent control and ability to contribute than one in which the instructional process is completely predetermined. For example, a fully computer-based

course is likely to be less acceptable than a collection of course segments and supplementary materials from which the instructor can choose and to which he can add.

We found individual faculty members willing to use technology when in their opinion it served the purpose better than their lectures. An example is a science teacher at a state university who chose to use a one-semester course that was on cassettes and dealt with an area where he felt his knowledge was weak. Another is a mathematics teacher who both made small units on cassettes, and used pre-canned segments of courses when they fitted into his course. Yet both of these individuals freely confessed that they preferred traditional teaching methods.

(3) Participation. Levien (ibid.) found that for faculty members, teaching is more than a way of earning a living. They are unlike other workers who would happily reduce their efforts if only their salary would not decrease. Since the very action of teaching is basic to their own satisfaction, they are not likely to view with enthusiasm endeavors to reduce their role. This is also supported by a finding of Evans (1967, p. 69). An intensive study of 319 faculty showed that they rate classroom lectures highest on a scale of 14 teaching methods, and television lectures and teaching machines lowest and second lowest. This does not represent merely resistance to change, for the same study found that faculty have "considerable concern" about teaching methods.

The general criticism in the past few years of undergraduate teaching and of faculty dedication to research has somewhat obscured the fact that higher education faculty are basically teachers. Only a small percentage of them publish consistently, a great many not at all. Most get rewards from and are concerned about their teaching. This fact alone is an untapped reservoir of good-will for the improvement of learning which the developer of technology might exploit.

In addition to their general but individual lack of enthusiasm for technology, the faculty as a power group in any given institution must be taken into account. Levien (ibid.) points out that in post-secondary institutions, decision-making is divided among administrators, faculty and students. And, "the major decisions concerning the conduct of instruction are reserved to the faculty." Most faculty members with whom we discussed technology were not totally hostile in their evaluation of its value in college teaching. However, they viewed it as supplementary to teaching and were negative about programs in which entire courses were taught by television or CAI. This negativism was usually the result of experience with pre-canned programs in instructional television at one or more institutions.

Academic Disciplines as a Factor in Innovation:

Perhaps the most important single factor in the organization of any faculty is their division into disciplines and departments, divisions, or schools. Such organized heterogeneity results in two problems for the promoters of technology: (1) the faculty at any given institution tends to view themselves primarily as specialists in art, sociology, physics, history, etc. and not just teachers at Siwash College or Great University. (2) Academic disciplines carry with them different philosophical orientations toward technology, most generally described as scientific and humanist.

Some subject matter areas are inherently constraining. We have already commented on the differences in the physical sciences on the one hand and social sciences on the other. As one chemist put it,

> "If I ask a question about the outcome of an experiment there is a limit to the number of answers. It is easier for me to use equipment to talk about these answers. But if I am instructor in political science and want to talk about the causes of the Korean War, for example, it would be far more difficult for me to use any equipment or any software program to facilitate my instruction."

Several teachers expressed concern at getting locked into a technology and consequently limiting the reach and depth of their pedagogical work. The complexity of equipment was also pointed to as a constraining factor in its own right, along with clumsy or time-consuming bureaucratic procedures for checking out pieces of equipment. At a small institution a simple calendar in a faculty meeting room might be enough to allocate any piece of equipment by date and hour.

One professor told us why he had selected a pre-canned television course, "Numerical Analysis." He was excited at the prospect of trying it because first, he respects the competence of the television instructors in a field where he is not especially qualified to give instruction. Second, each one of the video cassettes takes up only 22 minutes of any instruction hour, with the rest of the time available for discussion. And, third, each segment of the course is self-contained. Instructors can evaluate any segment and simply omit or cut those which they think are unnecessary for their purposes. (In fact, the authors of the course encourage them to do so.) The video cassettes (5" x 8" in size, sound and movie on a single tape for use over closed circuit TV) also come with a full set of notes which can be purchased for $4.00. A student can concentrate on the screen, taking only occasional notes. The cassettes can be made available in the library or any place with a TV monitor. Finally, the teachers and their personalities are highly visible on the video. One teacher, the Jefferson University instructor said, is somewhat irritating because "He seems to be going too fast, but that's alright, too."

Levien (1972) points out that programs which attempt to institute campus-wide changes in university instruction have little chance of success. This is primarily the result of the fact that the way any given subject is taught is based on the training of the individual faculty of that discipline which has usually taken place at a number of other schools. Within their department they arrive at group decisions by virtue of their basic homogeneity, as nurses, physicists, archaeologists, accountants, etc., while in their classrooms they teach very much as they were taught some time earlier in the graduate schools of that discipline. This results in any particular subject's teaching methods and textbooks resembling more the way that subject is taught at schools throughout the country than the way other subjects are taught at that school. This partly accounts for the fact that some subjects have had wide development of computer instruction, physics for example. (Schawarz, et. al., 1969). Levien (ibid.) thinks that even if 10 to 20 disciplines were incorporated into a university-wide innovation,

> the expense of maintaining differences in teaching style in the face of the flow of faculty members between institutions would tend to erode the distinctiveness of the innovation over time. (p. 538)

The differences in philosophical orientation among disciplines have resulted in a lack of development of technology in courses in the humanities and social sciences. One college vice-president thought the reasons for this were that in the "hard"sciences: (1) Course content is easier to define. (2) Desired cognitive outcomes are known. The head of the Computing Center at a large university remarked that when one puts material into a computer, one must know precisely what outcomes one desires. He thought the computer should be used in a supplementary manner in the

social sciences, because there is danger of "locking into structure" the types of problems that social science considers, and that could be "disastrous." Although the computer allows wide latitude in problem-solving, the economics of software design would tend to force widespread distribution of a given CAI sequence in order to provide suitable rewards.

In addition, of course, the hard scientists are the faculty members who feel most comfortable with the computer. They staff the institutes where large systems are being developed. Although they may visualize and even welcome its use in other disciplines, when it comes to developing courses they do so in the areas of their own expertise. At the PLATO project we visited, the most visible members of the team are an electrical engineer, two physicists, a chemist and biologist. The PLATO course listings for 1971-72 reflect this orientation. For courses using PLATO on a regular basis in 20 subject areas there were 21 courses in science, 23 in language and 3 in social science. (Lyman, 1972, p. 7)

Similarly, Levien's (1972) analysis of the Index to Computer Assisted Instruction shows that 890 programs of various length are distributed as follows: 25.8% Mathematics, 24.4% Physical Sciences, 12.4% Computer Science, 12.4% Professional training, 7.6% Humanities, 4.8% Foreign Languages, 3.1% Demonstration and games, 2.8% Business and Economics, 2.9% Social Sciences, 2.4% Student Services, and 0.7% Fine Arts. (The 7.6% of programs in the Humanities is not an indicator of higher education since almost of the programs are in Reading, Spelling and English.) (pp. 332-333)

Faculty in the hard sciences are also probably more receptive to other experiments in teaching by technology since they share the same feeling of familiarity with technology as do developers at CAI centers. An example is the report on instructional television by the Engineering School at

the University of Michigan. (Farris, 1970) The report states that:

> It has been refreshing to observe the enthusiasm with which most of the faculty have launched their instructional television careers. Their enthusiasm is contagious, and leads us to believe that excellence in teaching may come into its own reward again. (p.961)

The report goes on to say that after the newness of the medium had worn off, the faculty began to experiment with other ways of teaching such as "table-top demonstrations" and "remote access to the central computer... in design and modeling." This was the result of the staff at the broadcasting center who pointed out that teaching by conventional lecture "doesn't make much sense."

In contrast, a large university we visited had had very disappointing results teaching biology by closed-circuit TV. The head of A-V told us that the course was taught by four faculty members, but they did not operate as a team. Each instructor simply covered his particular area of expertise on the screen. The media specialist said that the program was scripted in an "amateur" fashion. He said that he had learned two lessons from its failure: (1) Biologists do not make good actors, (2) Whole courses taught by TV are constantly fighting the factor of student boredom.

The differences between the Michigan experiences with TV lectures and that of the university we visited is perhaps explained by these circumstances. (1) The Michigan program was aimed at an audience of engineers in graduate study and was paid for and beamed to industrial corporations. (2) The programming was done by a professional staff at a well-financed and well-equipped center, whose encouragement led the faculty members to experiment with teaching devices.

The attributes of the particular instructional audience are crucial to success. For example, engineers in industry viewing TV programs paid for by their employer would be likely to absorb the material in whatever form it was presented. But the interest of students in an introductory course in biology at a multi-versity must be seduced.

There are numerous references in the literature to the fact that lack of adequate software development is a primary constraining factor in incorporating computer technology into higher education (Koerner, Levien, Carnegie Commission). Anastasio and Morgan, in their monograph, Factors Inhibiting the Use of Computers in Instruction, attribute the general lack of software development to "The absence of economic and professional incentives for designing, developing and distributing CAI materials." (p. 20)

Many faculty members, particularly in the social sciences, have a fear and distaste for technological devices, we found. They did not make use of such simple classroom aids as overhead projectors, films, slides and audio-video cassettes which were available to them. One social science dean remarked that with faculty members and technology "the simpler, the better."

There is also a general sentiment among faculty members in the social sciences and the humanities that technology has ruined the environment. Since this sentiment is shared by many of their students they are resistant to even the simplest teaching device. (Hanna, 1970) This tendency to view technology with suspicion is reinforced by the fact that teachers and students are accustomed to prefer traditional instruction methods.

It seems doubtful that total computer instruction will be welcomed in the "humanist" disciplines in higher education. At the same time, however, A-V technology has found a place as a supplement in certain areas and in certain institutions. Slides have been used for years to show paintings, architecture, and sculpture in introductory humanities courses, for example. One Vice-President of a small, innovative public university (with a Ph.D. in Physics) said that as one moves from elementary to higher education, the computer becomes less appropriate as a tool for instruction. This may be the case to a greater degree in the "humanist" disciplines than in the "scientist" disciplines, as we noted earlier.

Generally, university-level faculty may be said to be more a constraining than a promoting factor for technology at the present and in the foreseeable future. This is more true in the social sciences and humanities than in the hard sciences. Resistance among all faculty is based on: (1) Lack of incentives to develop course materials. (A member of the PLATO team remarked that developing a good CAI course is the equivalent of writing a good textbook, and textbook writing is very rewarding.) (2) Loyalty to disciplines rather than to institutions which results in necessity for discipline-wide (and thus nation-wide) acceptance of any innovation, particularly technology. (3) The traditional autonomy of the classroom to which faculty members have become accustomed and which, together with tenure, is a basic component of "academic freedom."

Student Power

Like the faculty, and to some extent no doubt reflecting the faculty views, students resist new instructional technology. We found this resistance in mass as well as elitist institutions we visited, but for different reasons. The audio-visual director of an unselective multi-

versity said low-ability students sometimes feel "cheated" by TV lectures, films, etc. They regard it as entertainment, not education. Elitist students on the other hand tend to suspect a "dehumanizing effect" of technology on education. Evans (1967, pp. 56-57) found that students rated classroom demonstration first and classroom lecture second among 14 preferred methods of instruction. TV lectures and teaching machines ranked 11th and 13th. This is partly the result of what they were accustomed to experiencing in secondary schools.

Student attitudes toward computer-assisted instruction, though the evidence is limited, may have very little influence on the kind of instruction offered. (Levien, 1972 , p. 540) However, at two institutions we visited it was the students who were primarily responsible for the discontinuance of closed-circuit TV instruction in several courses. They had exercised their de-facto authority by exhibiting inertia and boredom.

Again resembling the faculty, students tend to regard technology in the same light as the discipline in which their major interest lies. In addition, and as we emphasized in Section I, student attitudes toward technology will differ depending on the type of student. In the next few pages we explore some of these differences.

The response of New Students to academic situations, many of them in junior/community colleges, is quite different from the traditional student with whom schools of higher education are accustomed to dealing. The latter are challenged by tasks of intermediate difficulty, and reject tasks that offer no challenge and those that are too difficult. They are "basically realistic, raising...aspirations with success and lowering them with failure." (Cross, 1971, pp. 22-23) In contrast, the

New Students choose tasks which are so easy that success is guaranteed, or so difficult that failure is expected and therefore non-threatening. By avoiding intermediate tasks where the outcome is uncertain, the New Student protects himself from the failure he fears.

Innovations in technology which hope to serve two-year colleges and the first two years of unselective multi-versities must develop programs geared to learners with a particular personality set and unique needs. Cross (ibid.) points out that there is little to be gained by remedial program aimed at turning New Students into traditional students. In the first place, by college age their patterns of learning and behavior are firmly established. Secondly, there is no real need for a larger proportion of traditionally trained college graduates. In fact, evidence suggests that we will shortly have an over-supply. Third, New Students will never be as successful in traditional academic areas as their more achievement-motivated competitors. But New Students have areas of competence which society needs.

> ...we need people to work with people; we need people to work with things; and we need people to work with ideas. I propose that we aim for an ultimate goal in which each citizen attains excellence in one sphere, and at least minimal competence in the other two. (p. 165)

New Students have a high interest in vocational training and are much more likely to have made a career choice on college entrance. Of even greater interest to innovators is that the early choice is due to New Students' perception of limited options; fewer choices make for easier decisions. Programs directed toward these students need to be aware of their vocational orientations and the limited choices which they perceive.

Some personality characteristics Cross (ibid.) found in the New Student

should interest innovators and lead to research about learning approaches which work with not against their limitations. First, Passivism. Twelve years of failure has led this group to quit trying academically. This was the obstacle most often checked in a questionnaire to administrators of junior college remedial programs. Cross suggests (a) a re-structuring the learning situation to induce them to try again (b) rewarding the effort. Next, Low Autonomy. New Students exhibit strikingly low scores on autonomy. They reflect the authoritarianism present in blue-collar families, regard hard work and ambition as virtues, respect tradition in church, school and government, and lack respect for those who think such qualities old-fashioned. Cross comments that in the town-gown polarization of attitudes, New Students reflect the attitudes of the community.

This orientation to tradition may lead New Students to be suspicious initially of non-traditional education in general. The A-V Director of an unselective school told us that a common reaction among freshmen to ITV was "My parents didn't send me to college to watch TV." Oakland Community College in Michigan has an interesting and innovative approach to the diagnosis of learning problems. Its President comments in an article in College and University Business:

> We meet many students who feel if they don't undergo some stiff lecturing and have to do a paper, then the class is mickey-mouse. I think some of the students oriented in this rigid style of education begin to realize that ease of learning isn't necessarily related to degree of learning. (Hampton, 1972, p. 14)

Third, Low Theoretical Orientation. New Students do not have self-confidence in intellectual tasks. They do not enjoy problem-solving. Cross comments, "failure-threatened personalities...tend to focus on 'getting the answer' so that they will look successful." (Cross, p. 37, pp. 44-45) One of the authors of this report, Lois Daniels, has had

four years' experience teaching low-ability, low socio-economic status, ethnic minority, high school seniors. Attempts to use the inquiry method (probing for answers) invariable evoked the question, "Why do we have to do this when you already know the answer?"

The fourth and final characteristic found by Cross (ibid). is Lack of Deferred Gratification. New Students are significantly less interested in working for a reward that is not immediate than are traditional students. At the same time, they are more likely to value grades, because they are tangible rewards. Cross comments that experiments in abolishing grades have been mostly at schools with elite students some of whom value "self-assessment derived from cues provided by teachers, other students and regular course activities..." (1971, pp. 36-37.)

Thus the logical steps in re-structuring college programs for New Students would seem to be: (1) Remedial, or Cross says "Re-Orientation to Learning" (p. 170), courses which do not attempt to re-make them into traditional students but which overcome their passivism toward any form of learning. (2) Programs based on their interest in vocational training and their interest in working with people and things rather than ideas. (3) Credentials (such as external degree programs) which are socially valuable, quality-controlled, and concentrated in areas which interest New Students and in which they can succeed as well or better than their academically-oriented, achievement-motivated competitors.

Oakland Community College in Bloomfield Hills, Michigan has pioneered in identifying the way an individual learns best by administering to entering students a three-hour battery of tests. The tests are based on "Cognitive Style mapping" of 84 traits by computer that describe how each student learns.

> The measured traits can produce 2,304 combinations that show how he handles qualitative and theoretical symbols, how cultural influences affect the way he gives meaning to symbols, and how he derives meaning from the symbols he perceives. In practice, the "maps"have produced up to 19 ways of teaching the same course material, each one aimed at a particular kind of learning style. (Hampton, 1972, p. 1)

Options available to the student include: (1) An Individualized Programmed Learning Laboratory with programmed texts, slide tapes, films, models and programmed reading machines. This center is manned by full-time faculty trained in its techniques. (2) Carrel arcades with video-tape lectures, films, audio tapes, slide tapes, paraprofessional staff in a supportive role, small group discussions, and trained student tutors who have mastered the same course materials and who are paid by the college. (3) Learning Resources Center with books periodicals, microfilms, research materials, and librarians who "assist students on a practical level with real course content problems." (Hill and Nunney, 1971)

Such individualized training is expensive. However, the egalitarian philosophy which has produced universal access to higher education has to be moved beyond admissions and into classrooms, libraries and budget departments. It is unrealistic to recruit people into a higher education system who have failed in the public schools; and then to innovate in directions which favor achievement-motivated students. The proportion of New Students in the total college population demands the re-allocation of resources. Cross (1971, p. 162) strongly suggests that "Colleges can be different and excellent too." If the unique needs of New Students receive funding priority, we can "make certain that 'different' becomes equated with 'best' until there is no longer any danger that it will be equated with 'least.'" This is a particularly promising area for technological innovation.

Another important segment in the emerging college population of the 70s has been termed "Third Force"by the Illinois Board of Higher Education. (1968) They differ from traditional students in elitist institutions and from the majority of students in junior colleges and in unselective universities as to age and educational interests. At a new institution we visited that had been founded to serve older students and students emerging from a junior college, the average age of students was 29. The administration felt that their principal motivation for returning to school was credentials. They were described by administration and faculty as frequently having trouble with communications skills. The school had beenfounded with a liberal arts base, but had just added 12 paraprofessional curricula in fields such as health services, computing and business skills.

In the past this population has frequently sought learning outside the traditional education system. Cross and Jones have identified this outside education as"The Education Periphery." (1972, p. 4) Increasingly, some of these educational tasks are being taken over by junior colleges and the new comprehensive colleges defined as a school type by the Carnegie Commission. (1971 b, appendix) The extrapolation on the following page is from a table in Explorations in Non-Traditional Study, and indicates the magnitude of this new population in 1970 and a projection by Moses of its size in 1976. (p. 42)

Of special significance to innovators is that studies predict an adult education boom for the 1970s and 1980s that is comparable to the explosion of regular enrollments that took place in traditional schools in the 1950s and 1960s. (Johnstone and Rivera, 1965, p. 51) As the table demonstrates innovations directed toward traditional students in traditional institutions of higher education reach only a small proportion of the higher education market.

THE LEARNING FORCE (MILLIONS)

			1970	1976
I.	Educational Core			
	1. Pre-Primary		4.4	5.5
	2. Elementary		32.3	30.0
	3. Secondary		19.8	22.1
	4. Undergraduate		6.5	8.3
	5. Graduate		.8	1.1
		Sub-Total	63.8	67.0
II.	Educational Periphery			
	6. Organizational (Training by employers)		21.7	27.4
	7. Proprietary		9.6	18.1
	8. Antipoverty		5.1	7.0
	9. Correspondence		5.7	6.7
	10. TV		7.5	10.0
	11. Other Adult		10.7	13.2
		Sub-Total	60.3	82.4
III.	The Learning Force (I + II)	Total	124.1	149.4

The rapid growth of community colleges is partly in response to the needs of adult students, and they do attract a greater proportion of such students than any other type of institution. The reasons adults seek further education are many and varied. They are related to age, sex, socio-economic status, past education, and social change. (Gould, p. 50) Some important factors include: (a) Vocational training for job change or improvement; to overcome technological unemployment; to meet demands for certification or new skills such as computerization. (b) Use of leisure time. (c) Women returning to job market. (pp. 50-52)

What of the Rebels, mostly within the ranks of elitist students? How numerous they are at any given time nobody knows. But even a small minority can work profound changes ultimately. Hanna (1970) in Bodies in Revolt observes that in the past higher education has been the developed and promoter of technology for the purpose of controlling the environment. The young students who are aware and critical of over-development of the environment (he calls them proto-mutants), reject technology and its principal proponents, the schools which develop it. (pp. 228-233) Though the rebels are often enrolled in elitist institutions, they "really do not want to be in college, have not entered into willing contract with it, and do not accept the values or the legitimacy of the institution." (Trow, 1970, p. 26) These students are usually found in departments that allow "undergraduate interests to be pursued in graduate and professional schools." They often drop out of departments "in vertebrate disciplines that have rigorous professional standards." (p. 28)

Like the potential elitists, the students who seek unstructured learning (discussed in the next section), the goals of the traditional rebels are in the direction of "self-awareness." (Hanna, 1970, p. 232) Hanna views this as legitimate in a society where technology has taken over most of the areas requiring "rational-intelligent labor." (p. 230) The result of such philosophical orientation has been the rejection of technology.

There is a lack of firm data as to what proportion of students in traditional institutions are in this category. Heist has studied students with high potential for creativity who have very high rates of transfer among traditional institutions. Cross and Jones feel that "The problem is likely to increase." (1972, p. 48) It is probably fair to say that

a large proportion of them are concentrated in the 'humanist' as opposed to 'scientist' disciplines discussed in Section III on faculty.

For most students in elitist higher education, traditional or rebel, technology has great potential as a tool. The problem is to demonstrate how it may function to free them from the inflexible schedules they reject, to broaden learning and thus add to the "self-awareness" they seek, and open up avenues of mobility for members of the population about whom they express concern.

For students with high ability in elitist institutions, Kemeny believes that the computer functions best in a supplementary capacity. Dartmouth's "Project Impress" has successfully taught students to use the computer for calculation, once the principles are grasped in mathematics and science classes. In the social sciences, it has been used primarily for information retrieval. Most Dartmouth students write their own programs for the computer. "In this process the student is the teacher and the computer is the student." (Kemeny, 1972, pp. 77-79)

Then there are students outside the system. They are probably few in number but large in their influence on innovation, as they seek learning experiences apart from traditional institutions and programs. As with the rebels within traditional institutions, their goals are related to self-awareness and the development of a life-style that frees them from a society whose goals they reject.

Nevertheless, there is some evidence that even students with high potential for self-development do not feel comfortable without structure and content. There is also some evidence that once they have experimented with such programs for a relatively short period, they seek structure and content in more traditional academic settings.

The Instructional Resources Departments recommended by implication in The Fourth Revolution, and which we found developing rapidly at some institutions, can have great impact on student attitudes toward technology. As with faculty, such departments, when properly staffed, can demonstrate the flexibility and inter-disciplinary potential of computers and other forms of technological innovation. Here, again, they may have to function as door-to-door salesmen.

The Innovative Power of New Academic Programs and New Models:

In the rush to innovate that has characterized the early 1970s, U.S. higher education has produced a wealth of programs ranging from new institutions which are completely non-traditional to small segments of courses. Assessing the place of technology in such innovations, includes a thoughtful appraisal of ways in which it may supplement higher education. James W. Hall, president of Empire State College, comments:

> Perhaps too many of our efforts have been directed toward the use of the media themselves as learning devices, rather than at whom and at what appropriate points it might provide help. (1973, p. 496)

Again, it must be emphasized that student needs are the first priority in innovation. Independent study programs require a highly motivated student unless they are accompanied by techniques which provide appropriate and constant feedback to faculty and the student. Constantly monitored independent-study is more, not less, expensive. For this reason many leaders in innovation have emphasized the appropriateness of their programs for certain kinds of students.

Since its creation in 1969 the Open University of Great Britain has created more interest among U. S. educators than any single model. Many of its materials are being used in the 1972-73 educational year for experiments at Rutgers, the University of Maryland, the University of

Houston and California State (San Diego). Funded by the Carnegie Corporation, the results are being measured by the Educational Testing Service. As we have already noted, Walter Perry, Vice Chancellor of the Open University, has made it plain in speeches and articles that the concept is not based on monetary savings. Many U.S. legislators, boards and administrations, on the other hand, look on non-traditional study as a means of reducing costs. (Nelson, 1972)

The Open University enrolls adults of 18 years and older. They pursue well-defined degree programs not unlike those offered in the older "closed universities" in the U. K. Nelson (1972) has noted four major differences between the British and U. S. educational systems that will, perforce, make any "Open University" in the U. S. unlike its British model. (1) In Britain there is consensus on the "meaning and rigor of the degree," whereas in the U. S. a degree is more reflective of its institution's own standards and philosophy. (2) British higher education is centralized in a compact country with only 44 universities, but in the U.S.A. fifty states are the arbitrators of public higher education. (3) Unlike Britain, there is a welter of proprietary community colleges, adult programs, extension programs, and special education offerings by business firms all available to adults beyond the secondary school level. (4) The British have a rigorous, classical approach to higher education.

One U.S. educator who visited the Open University in Britain concluded that it was "essentially a delivery system for a traditional education." A principal aim in establishing the Open University was to harness the new instructional technology. As it turns out, however, more emphasis has been placed on other methods of learning. Correspondence and independent study are combined with TV and radio broadcasts for each course.

A college vice-president told us that the emphasis has shifted to small-group meetings at centers close to the student's home. Another administrator found that the British students were very dependent on the "store-front tutors" for assistance.

One institution we visited was preparing to inaugurate a three-year degree program in the 1973-74 academic year. Their rationale for doing so was in line with the premises of the Carnegie Commission (1971a) in Less Time, More Options. (1) High Schools have improved, and the first college year is somewhat redundant. (2) Students are more mature. (3) Much learning takes place outside schools through travel and TV, etc. (4) Learning has become a lifetime thing. In the opinion of some educators like Derek Bok (1972), president of Harvard, there are some pitfalls in the three-year programs. That students are "captives" and therefore are frequently drop outs is no reason for reducing the total time spent. The "captive" students are a new segment of the population who are unable to prosper under traditional curricula.

Because there is more education in the high school, it does not follow that there should be less in college. Instead if there be cause for more learning in high school, why not learning in college as well? Bok finds that at Harvard and elsewhere students have expressed "massive indifference" to a three-year curriculum. What they desire instead is a flexible curriculum. The AB programs not being vocational, why shorten them in response to "lifetime learning" that is necessitated by ever higher job requirements? Bok thinks the real reasons behind three-year degree programs are to allow administrators to charge higher tuition rates and to enroll more women as undergraduates. His version of the three-

year undergraduate program would include a year of outside experience to bridge "the serious and perhaps widening gulf in values and understanding between the college population and the rest of society." (Bok, 1972, p. 16)

External Degree Programs:

The great variety of external degree programs recently introduced have been grouped by John R. Valley (1972) in six categories or types of models.

The Administrative-Facilitation Model is the oldest and the most common. Here the university keeps its traditional requirements, but enables students to meet them by evening classes, weekend classes, correspondence courses, TV lectures, or via video cassettes available at sites off campus. The changes "consist of assembling the services, organizational structures, and procedures that enable a new or different clientele to meet the university's regular degree requirements." (p. 98) The target audience is usually adults in the community. Since no concessions are made as to course content or curriculum,it can be assumed that the courses are sought by adults desiring traditional education, and capable of meeting traditional standards. Technology has been used extensively in this model, as for instance in the TV College of the Chicago Junior College System. Stanford offers a master's degree in engineering at surrounding business and industrial sites with telephone links which provide interaction between students and instructor. Colorado State University has offered master's degrees in several areas by video-taping classes and sending them by courier to industrial offices.

The Modes of Learning Model offers a different framework primarily for adults, but in some cases for all students who have "different capacities, circumstances, and interests." (p. 100) than those of the traditional student.

Typical, is the Bachelor of Independent Studies (BIS) at the University of South Florida. BIS students must be least 25 years old and give evidence that they cannot function as resident students. "The sequence of study is determined by the individual's ability, and the rate or pace is based on the individual's experience, previous learning, and the amount of time he can devote to study." (p. 103) Other Modes-of-Learning programs include the National Urban Studies Program and the University Without Walls. The first is sponsored by HUD for government employees (federal, state and local) who seek graduate as well as undergraduate degrees. It includes intensive seminars, equivalency examinations and recognition of work experience for credit. Cassette-recorded lectures, and other technology are incorporated into the learning package. Although this HUD program is sometimes called the "University Without Walls," this term in fact applies to another example of the Modes-of-Learning Model. (pp. 104-105)

The Union for Experimenting Colleges and Universities has established the University Without Walls with headquarters at Antioch College, Yellow Springs, Ohio. It is a consortium of over 20 colleges, each one implementing the program rather differently. A wide range of resources is emphasized, including technology, to tailor a program to student needs. There is no fixed curriculum, time or age range. The resources of all institutions are open to UWW students, but the source of student-faculty planning is a "continuing relationship with a residential college or university." (p. 105)

Although Valley (ibid) includes the Open University of Great Britain in this model, other writers and administrators we talked with thought it better exemplified the Administrative-Facilitation type. Valley places the Open University in Modes of Learning because it has "designed a new

curriculum and a new degree pattern for the students it serves." (p. 109) Others, however, emphasize its rigorous and traditional standards and exclude it, therefore.

Since 1858 the University of London has allowed external students to take the regular examinations of internal students, and awards degrees upon successful completion. Such is the Examination Model now emulated in the U.S.A. At London the admission standards are the same or higher than they are for regular students. In the U.S., however, the New York State Regents program is on an open admissions basis, with degrees granted by the New York State Education Department on the basis of oral and written examinations. Faculty members at regular schools in the New York State system "play a pivotal role in determining the kinds of examinations to be used and the standards to be set for degree requirements."(p. 110-111)

In the Validation Model an institution examines a student's total learning experience, giving credit for various kinds of courses such as adult education, military programs, correspondence. It then adds on certain requirements upon completion of which the student is awarded a degree. The add-on quality of such programs makes them particularly suitable for adult learners. (Valley, ibid.) Another version of this model has been in operation since 1956 -- the Advanced Placement Program. Here the credit for learning outside the traditional school takes place at the beginning rather than the end of the student's college career. More recent and broader is CLEP (College-Level Examination Program) in which 850 colleges and universities participate. CLEP awards credit regardless of formal study accomplishments. It extends the population to whom degrees are available, and offers a greater variety of study areas and examinations.

Credits Model. This type of degree is available at present in England through the Council of National Academic Awards. Since 1964 it has been granting degrees, and in 1970 there were over 20,000 British students in this program. The key to this type of degree is that "an institution or agency that does not itself offer instruction awards credits and degrees for which it sets standards and vouchers for the quality of student programming." (Valley, ibid.)

Complex-Systems Model. Here the degree-granting authority reshapes its services, sometimes by combining various aspects of external degree programs. Arbolino and Valley have proposed a "National University" in the U.S. that would give credits according to examinations passed following the Credits and the Validation Model. Empire State College (N.Y.) illustrates the Complex-Systems Type Model. It has an administrative staff and faculty but no campus. Operating through a network of regional learning centers throughout the state, Empire State College allows students to draw upon the resources of the entire state higher education system. Contracts are drawn up to "suit the needs, talents, vocations, avocations, career objectives, and goals of students." (Hall, 1973, p. 496) The course of study must meet the academic standards of other programs in the state system.

Instructional Technology and the Public

Although educators and academicians may take a public be damned viewpoint -- and rightly so in some things -- it is a risky viewpoint for Fourth Revolutionaries. The policy decisions of higher education become increasingly public matters as the process of massification and leveling continues. And decisions about instructional technology are policy decisions. By public we mean taxpayers, legislators, voters, and governing boards who allocate the funds. We do not include students, although most alumni are included.

Since the turn of the century higher education has been a channel of mobility up the social ladder for lower classes, as well as a certifier and social control for elites seeking to protect the established orders. It is these mechanisms, so important in an "open society," which have made higher education a favorite topic of utopians, reformers and dissenters. Especially in times of crisis the philosophies and methods of education are scrutinized. It is then that the consequences for personal ambitions and group aspirations are reexamined most avidly and most extensively. And it is then that changes in education are most likely. The rapid increase in community colleges and the adoption of open admissions policies are such changes, in response to the demands of publics who seek upward mobility, and of employers in a growth economy.

Power struggles over the control of higher education may extend to the control of instructional technology. Hylan Lewis (1970), a sociologist and consultant on urban problems, shows how this may occur. Taking CAI as the case in point, Lewis writes:

> The chances are getting higher that the things that will affect the ways in which CAI is seen and judged in urban centers will have relatively little to do with the state of knowledge either about computers or about teaching techniques. (p. 196)

The thinking of technologists, or administrators, and of academicians will not be decisive, in Lewis's judgment. He cites these factors that will figure importantly, especially in the cities: (1) Organizations of teachers with growing power over education. (2) Black parents, poor parents anxious to make their voices heard. (3) The conflict between teachers and parents over local control.

The conflict over control, Lewis thinks, may produce situations like this.

> the local urban poor...when made acutely conscious of their powerlessness, will be inclined to trade off any presumed advantages of innovations in education technology like CAI for control over, or a larger share in, school decisions. Under other circumstances, CAI may be accepted or bought as a means of hastening training or rehabilitations. (p. 200)

In such situations it is most difficult to predict what innovations will be accepted or rejected, demanded or merely tolerated.

The ethnic, race, and class attributes of the subject matters which are programmed become especially critical in all of this. Lewis advises Fourth Revolutionaries not to exclude, minimize or distort the place of Negroes, Puerto Ricans or Mexican-Americans and their contributions to American life. In fact, there is likely to be pressure to set the record straight and to redress past wrongs in this area.

> Innovations which are seen as doing little more than making existing practices more efficient and more impersonal are likely to be matters of deep concern to parents and students in inner city schools. (p. 201)

The key problems of CAI in urban areas are sociopolitical. They are part and parcel of the urban crisis and must be seen in this context. The metropolis itself has become a decision-making arena -- and with different urban actors -- than ten years ago, or even two years ago.

> Planners for CAI must see and respond to the whole picture--the total spectrum of potentially organized and actually organized power segments in the metropolis. If the awareness and responsiveness of the planner in the area are weak...the spread and wholesale adoption of computer assisted instruction can only be a "massive enlargement of human error." Participation of parents and students in planning and programming is the best antidote to bringing the wrong postulates to the application of CAI. (p. 203)

Part Four

BUILD INNOVATIVE NETWORKS

All successful revolutionaries know that to work great changes in established institutions it takes organizations--new organizations that destroy routines and that lead to the creation of new social forms and processes. The Fourth Revolution is no exception, particularly inasmuch as higher education is known for its inertia and custom caked rigidities.

In the National Picture:

In 1973 one sees a few beginnings of revolutionary movement; which is to say, the nascent organization of groups and people to promote the new instructional technology. One such beginning on the national scene is the redirected "Audio-Visual Cult," as it is called by a prominent Washington educator. This grouping includes: (1) the National Association of Educational Broadcasters, (2) the Association for Educational and Communications Technology, (3) the National Society for Program Construction (staff offices at Catholic University in Washington), and (4) the American Educational Research Association. The targets of "the cult" are said to be colleges and universities, but they are thought to be tough customers.

> We are wrestling the administrators, but so far we have not gotten very far because we have never been able to demonstrate even the instructional effectiveness of the new media, much less the cost effectiveness.

One wonders how well A-V enthusiasts wrestle. They say,

> The inescapable conclusion of all of the research done under Title Seven of the U.S. Education Act in recent years has failed to show a simple or significant difference between new and conventional methods.

Does not "no significant difference" mean that the electronic technology is effective?

The JCET (Joint Council for Educational Telecommunications) is another beginning. JCET was created by some of the organizations listed above with the intention that it be a bridge between educators and technologists. However, an alarming number of higher educational institutions that joined at the beginning have now dropped their memberships. JCET dues was apparently a factor. The Association of Universities and Land Grant Colleges dropped their membership because, they said, they could not find $1000 for annual dues. Nor could they find even $300 for an associate membership. The Association for Higher Education also dropped for the same reason, "An incredible kind of thing to my way of thinking," said one would-be revolutionary.

The Association for Educational and Communications Technology occupies a somewhat different beachhead. The history of this Association goes back to the 1920s when the movies began to be used for instruction. Then came the popularity of museums and most of the things that have been around for a long time. For example, the idea of "educational parks" is now going around for about the third or fourth time, we were told. Formerly a division of the National Education Association, AECT is now an autonomous organization with its own staff and journal, "The Audio-Visual Communication Review." AECT backs a movement called "instructional design." Here the greatest obstacle is said to be getting academic Vice-Presidents at a significant number of institutions to support teaching-learning experiments with the new technology. At Michigan State University, however, a Provost has backed "instructional design" and there has been notable accomplishment there.

In the junior and community college sector there are at least two consortia that have formed for the purpose of promoting innovation generally, and which may eventually include--if it has not already--experimentation with the new technology. There is the League for Innovation

composed of some 15 junior college districts with about 35 institutions. A second innovative grouping is GT-70 with an office in Washington.

The American Association of State Colleges and Universities is very "development minded," as one would expect of such institutions ("The Colleges of the Forgotten Americans"). As early as the fall of 1972 the Washington staff had already prepared a digest of The Fourth Revolution and forwarded it to their presidents. A manual prepared for the Association's "National Commission on the Future of State Colleges and Universities," is a how-to-do-it on institutional self-evaluation and planning. Here there is reference to teaching-learning technology and study. The staff identified a dozen of their member institutions which have been experimenting with dial-access in the dormitory, video tape libraries, films for teaching biology, and so on.

With the change in 1972 of its top officers, even the American Council on Education went on record supporting the recommendations of the Carnegie Commission. Furthermore, the ACE Board decided that henceforward one of the Council's main functions in Washington would be to help follow through the recommendations of this and other reports whose implementation hinges in part upon actions by the United States Government. At the annual meeting of the Council in 1972 at least one session heard a position paper that was very sympathetic to technological innovation. The author, ACE staffer Todd Furniss, argued that it is fallacious to think of the new technology as being the same old stuff as the old, poor quality educational television. CATV, Furniss observed, offers all kinds of flexibility. So far as the possible unemployment of professors is concerned, he thought there was enough to be done in creating educationally effective programming to keep everyone employed.

ACE's interest in the new technology is reflected in the Council's inquiry into the nature of a cost-benefit methodology for higher education. It is recognized that the cost questions in higher education are inseparable from the educational benefit and instructional technology questions. At the Western Interstate Compact for Higher Education (WICHE), the National Center for Higher Education Management Systems is reported to have already identified the input variables in a cost accounting model, and to be well along on the analysis of output factors.

As of October 1972 when we interviewed the U.S. Office of Education, the principal promulgators of new technology appeared to be in the Offices of the Deputy Commissioner for Development, at the Commission for Library Training Resources, and in the National Institute for Education. There is also the Office of Telecommunications in the Office of the Secretary, Department of HEW. This is an advocacy operation to promote the use of education technology broadly, not only in higher education. The Office has assisted demonstration projects involving both satellite and cable. One such project, the Health-Education Telecommunications Experiment, has been supported by HEW, NASA and the Corporation for Public Broadcasting. This involves the use of NASA's satellite (the ATS-F satellite) for educational and health telecommunications in the Rocky Mountain states, as well as in Alaska and Appalachia. Studies of the use of technology in various settings, including the several open university efforts in the United States, have also been commissioned. The Office of Telecommunications had hoped that the White House would support the "Human Resources Telecommunications Act" in 1972, but because of "difficulties" with legislation for the Corporation for Public Broadcasting no action was taken on the bill.

Urban colleges and universities with cable information centers, the Lister Hill Center for Biomedical Communications (in the National Medical

Library at Bethesda),the Technology and Productivity Task Force at the NIE, and the National Center for Educational Technology are likely units in a fourth revolution movement, especially if they cooperate and if their leadership possesses a "derring do" quality. Finally, we note the Interuniversity Communications Council of the Educational Testing Service, a private sector grouping that has issued a number of study reports; and the Commission on Non-Traditional Study, headed by Samuel Gould, former President of the State University of New York. The Commission's final report includes consideration of the new technology and was published in 1973.

Innovating by the College or University:

How can the testing, trials, and innovation of the new technology be brought about in the colleges and universities? Organizations at the national level cannot do this alone. Nor should the individual institutions accept uncritically the urgings of outsiders, especially in the present state of our ignorance. Needed over the next 10 years are fine-grained trials and evaluations in local settings with careful consideration given to student needs, program goals, faculty resources, costs and benefits both social and economic. But how can institutions bring themselves to try out the new technology at all?

Much of what is termed "institutional research" at colleges and universities is of little value presently so far as innovating the new technology is concerned. Admissions, enrollment, budget and income trends, however valuable for some purposes, often lack any bearing on questions of educational policy, program options, and innovations. Much of this social bookkeeping is done by a low-grade staff buried in the table of organization and influence. Their frequent basement habitats are perhaps symbolic.

Either the chief executive himself or a member of his top executive group should give leadership and direction to performance analysis and planned innovation as a continuing and regular function of the central administration. This activity should comprehend and relate internal operations and the accomplishment of programmed objectives as well as external factors and trends affecting the college's future. It is the second, the external setting, that is most often neglected or underemphasized.

Most colleges and universities do of course look about periodically as troubles with financing, enrollment or public relations arise. Like other kinds of organizations, colleges look for the causes of their problems and the search is often outside. But the search conducted is typically according to some rather simple ideas of cause and effect: (1) Find out how a particular problem might be alleviated by altering it in a limited respect. (2) Once an alternative or option that looks especially promising is identified, see if there may not be something else of the same sort which might work out better. If these two procedures do not produce an acceptable solution, there is then a tendency to look into parts of the organization where power is weak or where there is slack in the activities that are carried on.

In contrast to this simplistic search after amelioratives for existing problems, J. D. Thompson (1967) recommended a quite different strategy, "opportunistic surveillance." This kind of search with a two-directional focus, is especially applicable to collegiate situations. And it fits well the possibilities and questions of the new technology. By "opportunistic surveillance" is meant a continuous monitoring of the institution and its activities, a monitoring which in Thompson's words:

> ...scans the environment for opportunities--which does not wait to be activated by a problem and which does not therefore stop when a problem's solution has been found...it is the organizational counterpart of curiosity in the individual. (p. 151)

Opportunistic surveillance is of course no substitute for solving the problems of existing operations and already programmed activities. The more simple searching is necessary and so are the faculty, staff, and students who do it. The point is that this is not enough. Institutions through their leadership ought to generate and exercise their curiosities more broadly and without the fetters of things as they are. In other words, opportunistic surveillance is no less important than problemistic search. It may come harder, however, for those academic non-leaders who only hold their offices and think their jobs are somehow impregnable to the winds of change, or who cannot tolerate ambiguity or uncertainty.

In monitoring the changing demands and possibilities in an institution's setting, the surveillance of its power picture is essential. We refer to the shifts in methods of influence or control in the alliances and positions of the power figures, power centers, power elites both inside and outside the college or university. That old structures do not endure and that new ones are predictable is quite evident. And yet there are prominent educators who, though they observe that higher education is in the midst of a "time of troubles," nevertheless go on to describe the collegiate agenda as the unfinished business of the last hundred years. To expect simply more education programs of the kind now offered generally, combined with greater and greater accessibility and enrollments, is quite unrealistic. The counterforces are simply too strong.

Builders of regularized innovating whether it be the new technology or anything else will need to develop a particular capacity within their institutions. Some of the hallmarks and elements of the capacity to innovate

may be seen in the three categories of factors listed below, following R. W. Gerard (1967).

Factors in Innovation

Facilitating	Retarding	Blocking
1. Prestige influence of the leaders	1. Conservatism	1. Rigidification or fixation of old structures and procedures
2. Accreditation by outsiders	2. Vested Interests	2. Persistence of old structures
3. Foundation support	3. Unawareness of changing goals	3. Success and increased size
4. Continuity supplied to governing boards, staff and faculty	4. Difficulty of re-organizing subject matter fields	
	5. Conflict between teaching and research	

As classifications go, all right. But what do Fourth Revolutionaries do to maximize facilitating factors?

Our case studies and research by others show that faculty and students desire to participate in planning as well as in executing innovative action. B. Lamarr Johnson's (1969) account of innovation at numerous community colleges emphasizes action and process. He finds that junior colleges with the following attributes and conditions are the more innovative and experimental.

1. An atmosphere that stimulates and supports creativity in teaching (and other things) and which includes the "right to fail" when new ideas do not prove successful.

2. Informing faculty members about innovative developments at other places by visits, by conferences, and by reading.

3. Budgeting for innovation by providing:

   a. Generous funding of multi-media instructional facilities, and money specifically for innovative activities.
   b. Salaries for faculty members to work on new instructional tools and to promote innovation.
   c. Funds from foundation and government grants to support experimental plans or programs.

4. Allocating certain funds in a manner that stimulates and offers incentives to novel methods of instruction that produce financial savings and also improve the quality of teaching.

5. Make the newness of new institutions an occasion to launch out in new directions.

6. Identify and legitimate agents of change both inside and outside the institutions.

7. Involve faculty members (and student leaders), who are responsible in the last analysis for what occurs in classrooms, when planning and programming new developments.

Alas, such innovating and experimenting organizations are rare, as Johnson ruefully observes.

> These plans and practices are not, however, widely used. On the contrary, only occasional colleges for example, budget for innovation, generously provide multi-media instructional facilities, or arrange faculty travel to centers of innovation. (p. 288)

Why is this the case? How can the innovation-minded leader go about getting innovation in his institution? We think that this can best be done by organization development, a promising strategy at those institutions which are more prone to perpetuate their past than to alter their future.

The point of organization development for innovation is this: the effort goes to improving the organization as a system and not to changing people's personalities. It does not impose outside criteria or models from other kinds of undertakings or cultures upon a given educational entity. Granting the peculiarities of higher education and its institutions, there is no reason to believe that colleges are so different from others, and that OD strategy has no place there. On the contrary, unless this approach or another one much the same be used, we cannot see how Fourth Revolutionaries can hope to achieve the capacity to innovate the new instructional technology.

Although the organization development methods used at any given

institution must be worked out especially for it, some general characteristics of the strategy may be noted. Briefly summarized, OD stresses the importance of working through carefully constituted interpersonal relationships and activities in pursuit of such task objectives as the following: (1) To increase the ability of individuals and groups within an organization to confront the challenging promise of technology instead of sweeping it under the rug of custom. (2) To increase levels of trust and support among faculty, administration, students and external allies. (3) To create environments wherein officially legitimated authority is coterminous with recognized skills, knowledge and influence. (4) To increase openness of communication (laterally, vertically, diagonally) within the collegiate organization. (5) To increase the level of personal enthusiasm and satisfaction with membership in the organization. (6) To make use of the natural creativity of individuals and small groups within the organization. (7) To increase the level of self-responsibility and group responsibility in planning and implementation. (8) To gain increased acceptance of the mechanisms of program budgeting and management together with new means and resources for greater productivity.

The key idea of all organization development is the finding of Kurt Lewin, the social psychologist, more than thirty years ago. Individuals will be more innovative and more productive, and their commitments to their work groups will be higher when they can participate in decisions effecting their behavior.

Unless educational leaders can make this concept work, how can the promise of the Fourth Revolution be tested, much less realized? How, indeed, can our colleges and universities be made worthy of their clienteles?

SUMMARY

We have written a manual for those who would act in behalf of a more extensive use of telecommunications in higher education, U.S.A. Our own case studies and our personal convictions together with our reading of the relevant literature, have led us to formulate four principles of innovative effort. These are the headings of the four parts of this monograph:

I Recognize the Diversity of Higher Education, U.S.A.

II Learn from Experience

III Encourage Innovation, Curb Constraint

IV Build Innovative Networks

Behind each of these general admonitions, the major findings and conclusions are these.

The diversity of higher education in this country is great and evidence of an "establishment" is little. Massification runs strong but elitism is persistent, especially in "the better institutions." Diverse student types (New Students, Elitists and Rebels, Older Students, Forgotten Americans) will require quite diverse applications of telecommunications technology if there is to be a Fourth Revolution. Technological diversity is likewise indicated by the diversity of institutions in respect to educational mission, control and sponsorship, size of enrollment, student-teacher ratio. Nor will the ramparts of higher education be stormed by Fourth Revolutionaries carrying shotguns. The diversity of associations and lobbies officed in Washington is too great and their likely receptivity to new instruction technology is too varied for that.

At the Rivers Junior College District, Southeastern University, Waxford College and Jefferson University -- all pseudonyms -- we found no extensive

use or great enthusiasm for the new technology in either its hard or software aspects. Quite mixed attitudes and sentiments were encountered. While our data gave us no positive answers to tactical questions, they do point to several areas for human factors inquiry. For example, CAI -- just how, where, and how well does it work? Perhaps the PLATO and TICCIT demonstrations now underway will yield some answers.

The roles of administrators, faculty, students in innovating the new technology -- and then getting it used, quite a different matter -- are as different as they are important, each in its own way. The question of "cottage industry" or larger scale production of software we found widely mooted. Generally, we found administrators, faculty, and students apathetic toward the use of totally planned and canned courses whether by computer, TV or video cassettes. For example, one institution had experimented with a philosophy of education course by a famous scholar on TV. It lasted only two semesters. The Dean explained, "Better an average teacher with whom one can interact than a brilliant teacher with whom one has no contact." If there was to be telecommunicated instruction, most of our interviewees thought it should have a local, indigenous quality. On the whole, the cottage industry approach was favored, no matter the problems of cost and quality inherent in this.

New academic programs and new models of education hold the most promise for technology innovators External degree programs hold special potential because they can apply to several kinds of students to the extent that the programs do three things.

a) To the extent that they credit non-academic experience, they apply particularly to New Students and to mature adults. However, the credits and credentials will enjoy good repute only so far as they are based on standards as high as those of traditional degrees. That is, they should reflect a change in emphasis, not quality.

Further, it seems important that the New Students perceive learning experiences as both feasible and pleasant before they attempt individualized study.

b) To the extent that they permit transfers of credits between institutions, they will be valuable to mature adults whose jobs require mobility and to other students who seek a variety of experiences in education.

c) To the extent that they allow students to structure their own curricula and course content, they can serve highly motivated students who are discontented with the restrictions of traditional institutions.

It is likely that the rapid expansion of external degrees will promote the use of technology. The flexibility it promises will be an important component of such programs. In fact, without such flexibility these programs can hardly be expected to succeed. External degree agencies may well be a key source of technological innovation. And as they send their students into traditional student bodies, these students may prove to be effective change agents, persuading their fellow students to appreciate the positive aspects and potential of technology. This in no way diminishes the importance of building innovative networks of persons, associations and institutions. The Fourth Revolution will not just happen.

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